

In our hands, anterior resection is a more dangerous procedure than an abdominoperineal resection and an improvement here can confidently be expected.

Seven of the colonic deaths were from peritonitis, 2 from pulmonary emboli and one from bronchopneumonia.

Table 5

Anterior resection for carcinoma of the rectum

	Total cases	Deaths
Safety valve caecostomy	10	1
Transverse colostomy	73	3
No decompression	65	7
Total	148	11

The causes of death in patients treated by an abdominoperineal excision were: Pulmonary embolus 2, injury to ureter 2, hæmorrhage 2, senility (85) 1, splenic abscess 1, cardiovascular 3, hæmatemesis 1, acute obstruction 2, renal failure 1, suprarenal failure 1, agranulocytosis 1, injury to bladder 1, peritonitis 2.

The causes of death after restorative resection were: Peritonitis 3, liver secondaries 4, pulmonary embolus 2, pneumonia 1, uræmia 1. It appears that patients who have a temporary colostomy stand a better chance of survival, as the risk of sepsis is thereby diminished (Table 5).

Late Results (Table 6)

I have classified both the rectal and colonic growths on the basis of A, B and C cases as first described by Dr Cuthbert Dukes.

The figures shown are five-year survivals, since it is well known that if a patient with large bowel cancer lives for five years he or she is most unlikely to get a recurrence and many of these patients have lived fifteen or twenty years post-operatively. My longest survival is a man with carcinoma of the pelvic colon on whom I operated as a surgical registrar in 1936.

Table 6

Carcinoma of large intestine: five-year survival

	Grade A cases		Grade B cases		Grade C cases	
	Total	Alive	Total	Alive	Total	Alive
Right colon	14	9	13	6	15	6
Transverse colon	3	2	6	3	15	4
Left colon	4	2	7	5	7	4
Pelvic colon	16	12	16	3	13	3
Anterior resection	22	16	39	17	49	2
Abdominoperineal	59	45	120	46	110	25
Hartmann's operation	5	2	15	5	16	6
Pull-through	2	2	1	1	3	0
Survival rate for colons		67%		40%		28%
Survival rate for rectums		73%		39%		19%

I have treated only 18 patients under the age of 40; 5 have lived over five years and one of the survivors was 26 at the time of her operation.

Thirty-three patients with carcinoma of the colon came in with acute intestinal obstruction: 27 of these were operated upon five years or more ago and 8 survived five years, a survival rate of 29%, which is the same as the five-year survival rate for Stage C cases.

In Grade A cases the survival rate of carcinomas of the rectum is 73% and that for carcinoma of the colon is slightly less, 67%.

In Grade B cases the chief point of interest is the long-term survival of patients with carcinoma of the left colon, despite extracolonic spread.

Grade C cases show the usual sad picture of the late case and this again emphasizes the importance of early diagnosis in large bowel cancer.

Bowel Sounds

by Basil Georgoulis MD

(First Surgical Clinic, Athens University,
at King Paul's Hospital, Athens, Greece)

Bowel sounds after abdominal operations have been studied by King (1931), Stevens (1936), Vaughan & Thorek (1939), Du Plessis (1954), Baker & Dudley (1961) and, in a more systematized fashion, by Wells *et al.* (1964).

The research described in the present study has a dual purpose: first, to find an objective method of classifying and measuring sounds from the intestines and, secondly, to study such sounds, after an abdominal operation, by continuous recording for at least the whole of the first forty-eight post-operative hours.

A microphone in the abdominal wall picks up conversation and ward noises in addition to intestinal sounds. By contrast, a microphone placed inside the rectum picks up intestinal sounds free from extraneous noise. In this way the the intestinal sounds of 10 patients have been studied for a continuous period of forty-eight hours each, beginning in the first hour after the operation.

In this study there is no mention of pre-operative bowel sounds because there are many factors, such as the time of day and food intake, influencing these sounds that must first be studied and allowed for. Work on this comparison is still in progress and will be published later.

Method

An egg-shaped capsule (Fig 1), about 4 c.cm in volume, made of plastic material, is introduced into the rectum. A sensitive microphone within the capsule is connected through a fine lead to a tape recorder.

Experiments in dogs having proved successful, observations were made in volunteers with similar satisfactory results. The bowel sounds proved loud and clear whilst the common ward noises were not recorded at all. None of the volunteers complained of discomfort.

In the study of post-operative bowel sounds, the capsule was introduced into the ampulla of the rectum, before recovery from anaesthesia,

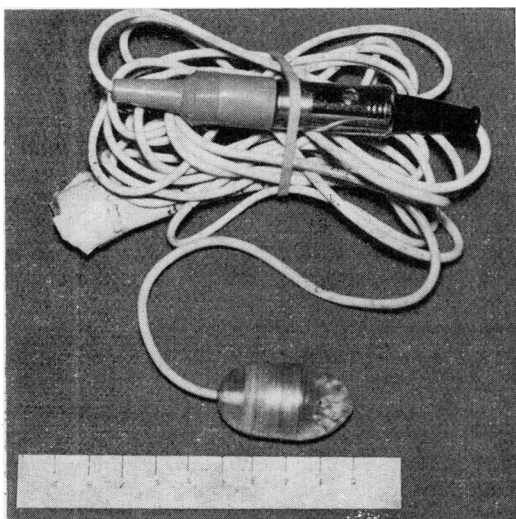


Fig 1 Egg-shaped capsule. A sensitive microphone within the capsule is connected to a fine lead

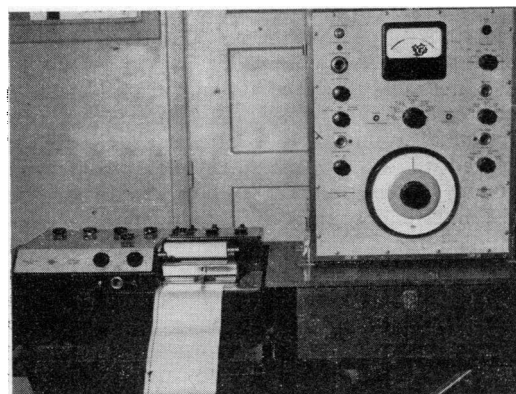


Fig 2 Bruël-Kjoer sound analyser and continuous-roll recording instrument

and recording was started on return to the ward, usually within the first post-operative hour.

The process involves, first, the picking up of the sounds on magnetic tape, and secondly, their conversion to a visual record. The sounds reported were recorded on tape by a Telefunken magnetophone 97, in the ward. For the second stage the tape record was taken to the central laboratory of the Ministry of Public Works, where it was connected to a Bruël-Kjoer Sound Analyser and continuous-roll recording instrument. For the analysis of the sounds a B filter was used (Fig 2). The optimum paper speed was found to be 0.3 cm/sec, and this was maintained for all the recordings.

The recording of intestinal sounds for forty-eight hours and their transcription by this method requires one hundred hours' work for each patient and it is for this reason that only 10 patients have been studied up to the time of writing.

Classification and Measurement of Intestinal Sounds by the Method Described

The graphic representation of the sounds recorded was divided into two main categories, simple and compound. Simple sounds are those which, when recorded under the conditions described above, appear as a vertical line (Fig 3). The relatively slow movement of the visual tape (as compared with the sound-record) accounts for the fact that the 'spike' of the simple sound is shown as a single, vertical line, its duration being too brief to produce a measurable or indeed a visible spread due to time, at the base of the peak.

The compound sound is of longer duration and is recognized audibly as a run of individual 'popping' effects. When visually recorded in the manner described, these sounds are so closely in succession that the tracing has insufficient time to return to the base line and a tented appearance results (Fig 3).

Each of these categories is divided into three classes according to the strength of the sounds. This strength is shown in dB (decibel) acoustic units on the vertical axis of the graph. By this classification, the first class comprises sounds,

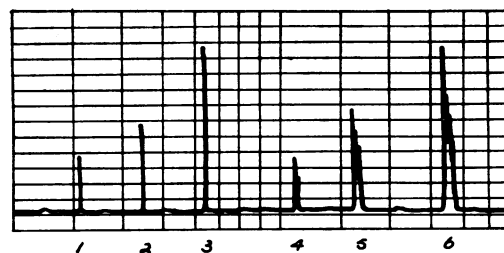


Fig 3 Simple (1, 2, 3) and compound (4, 5, 6) bowel sounds



Fig 4 Mean distribution of the total number of intestinal sounds

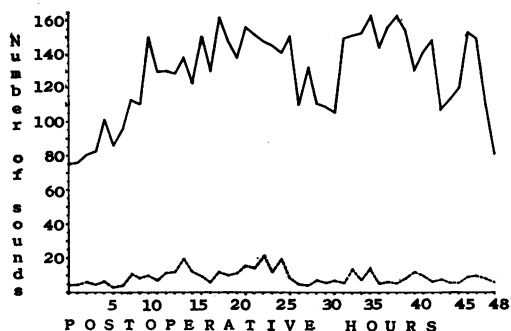


Fig 5 Mean distribution of simple and complex intestinal sounds in 10 cases. —, simple. ---, compound

simple or compound, with a strength of 47–52 dB; the second, those of 52–57 dB; and the third, those over 57 dB.

The intestinal sounds in every period of five minutes – i.e. in every 90 cm graph length (paper-speed=0.3 cm/sec) – were counted. These figures were then converted to the number of sounds per hour, to obtain the figures shown in Fig 4. A complete absence of intestinal sounds for five minutes or more was classified as an interval of silence, the longest interval of silence in normal people being four minutes (Milton 1958).

Cases

The following is an example of the details compiled for each case from the analysis of the tables appended.

Case History

Gastrectomy (Billroth II) for duodenal ulcer

KN, 50 years old

Recording began in the first post-operative hour and continued for forty-eight hours with a short technical break from the 19th to the 22nd hour.

Simple intestinal sounds of the first class were present for the whole period of recording, showing fluctuations whose only characteristic was a fall after each rise. The compound sounds present during the whole period of recordings disappeared almost completely between the 9th and the 18th post-operative hours.

The longest interval of silence was fifteen minutes, recorded during the 3rd, 5th, 8th, 39th and 44th post-operative hours.

Conclusions

From the study made, the following conclusions are drawn:

(1) The most frequent intestinal sounds regularly encountered throughout the post-operative period studied are simple ones of the first class (Fig 5). The longest interval of silence between these sounds did not in these cases exceed thirty minutes (Fig 6). Studies previously published have stated that this interval can be as long as forty-eight hours. The reduction of the observed interval to thirty minutes is due to the greater sensitivity of the method used and to continuous

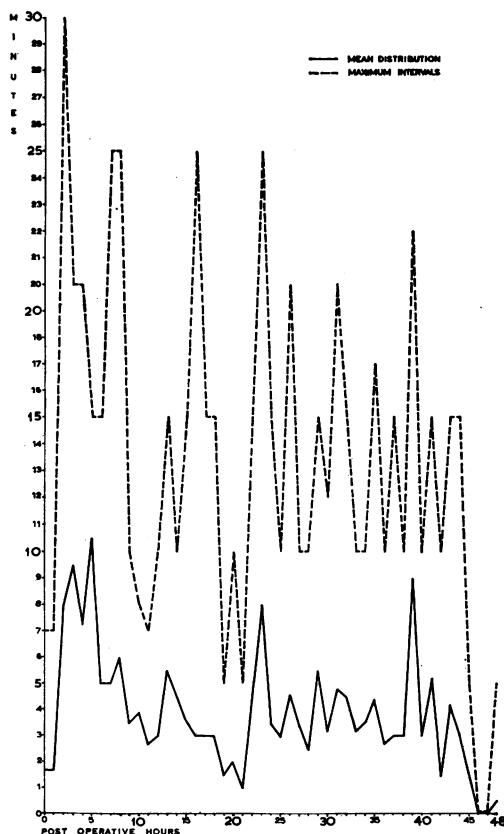


Fig 6 Intervals of silence: mean distribution and distribution of maximum intervals. —, mean distribution. ---, maximum intervals

recording for forty-eight hours which reduces to a negligible figure the probability of error.

(2) Compound intestinal sounds occur, in most cases not from the beginning, but a few hours after the time of the operation. They intermittently disappear for the space of an hour or two (Fig 5).

(3) Intestinal sounds, even in the pre-operative period, show wide variations from person to person.

(4) No precise pattern has been shown for the post-operative progress of intestinal sounds hour by hour. The only firm discovery is the fall in the number of sounds following each rise.

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Post-anal Perineorrhaphy for Rectal Prolapse [*Abridged*]

by Alan G Parks MCh FRCS
 (The London Hospital and
 St Mark's Hospital, London)

Rectal incontinence is a distressing symptom which may occur as the result of neurological disease or division of the sphincter muscles. It is also found in patients with an atonic pelvic floor of no obvious cause and most of these have rectal prolapse as well.

Phillips & Edwards (1965) cast doubt upon the classic concept that the sphincters enable continence to be maintained by simple closure of the anal canal. They suggested that the sphincters cause partial closure and that the final seal is provided by mucosal flaps which are forced into the upper part of the anal canal by intra-abdominal pressure. This type of mechanism is called a flutter valve. Inadvertent rise in intra-abdominal pressure will automatically result in even firmer closure of the valve so that stress incontinence is prevented. Parks *et al.* (1966) have recently suggested a modification of this hypothesis to fit the

local anatomical arrangements more precisely. The terminal part of the gut changes from rectum to anal canal by turning a right angle. The upper aperture of the anal canal is thus in direct contact with the mucosa of the anterior rectal wall. With rise of intra-abdominal pressure the mucosa is driven on to the upper anal canal and constitutes a flap valve. This valve mechanism is dependent upon the presence of a sharp anorectal angle. Patients with idiopathic incontinence have a dropped pelvic floor with loss of the anorectal angle. Any attempt at repair must reconstruct this angle by building up a muscle bar behind the upper anal canal. Attempts to achieve continence by muscle apposition in front of the anal canal have met with almost universal failure in the past, chiefly because this approach does nothing to restore the anorectal angle.

A new technique is described in which the levator muscles, puborectalis and sphincter muscles are apposed behind the anal canal. An incision is made well behind the anal orifice and the plane between internal and external sphincters defined. This intersphincteric plane is pursued posteriorly and laterally so that the anal canal is lifted forwards off the sphincter, puborectalis and levator ani muscles. The true pelvis is opened by division of Waldeyer's fascia. No damage is done to the innervation of the muscles which enters them from the other surface.

Once the dissection is complete the repair is carried out by laying sutures between the levator muscles of both sides. At a lower level another lattice of sutures is placed into the puborectalis muscle. These sutures are not tied tightly, a gap is deliberately left between the apposed muscles to avoid avascular necrosis. In this manner the pelvic floor is raised and the anorectal angle restored. Similar sutures are placed into the external sphincter muscles which narrow the anal canal.

The repair is readily disrupted by defaecation straining. In the immediate two weeks after operation this is avoided by ensuring that the patient has diarrhoea and does not pass a solid stool. This is achieved with adequate doses of magnesium sulphate. Even after tissue union is complete the repair will gradually stretch if the patient strains during defaecation. Thereafter straining must be avoided at all costs and the routine use of glycerin or bisacodyl suppositories is usually necessary.

It is essential to select patients carefully for this procedure. It is not effective as a primary procedure when a large rectal prolapse is present. It is best in the younger age groups who still have an active pelvic floor musculature. Patients who are